the Bulletin

BROOKHAVEN NATIONAL LABORATORY

Vol. 59 - No. 1 January 7, 2005

# Aerosols Lead to Climate of Uncertainty

Climate scientists agree that atmospheric carbon dioxide ($CO_2$) has increased about 35 percent over the industrial period and that it will continue to rise so that $CO_2$ will reach double its pre-industrial value well before the end of this century. How much this doubled $CO_2$ concentration will raise Earth's global mean temperature, however, remains quite uncertain and is the subject of intense research — and heated debate.

In the November issue of the *Journal of the Air and Waste Management Association*, Stephen Schwartz of BNL's Environmental Sciences Department argues that much of the reason for the present uncertainty in the climatic effect of increased $CO_2$ arises from uncertainty about the influence of atmospheric aerosols, tiny particles in the air.

Schwartz, funded by the Office of Biological & Environmental Research within DOE's Office of Science, is chief scientist of DOE's Atmospheric Science Program. He points out that aerosols scatter and absorb light and modify the properties of clouds, making them brighter and thus able to reflect more incoming solar radiation before it reaches Earth's surface.

"Because these aerosol particles, like $CO_2$, are introduced into the atmosphere as a consequence of industrial processes such as fossil fuel combustion," says Schwartz, "they have been exerting an influence on climate over the same period of time as the increase in $CO_2$, and could thus very well be masking much of the influence of that greenhouse gas." However, he emphasizes, the influence of aerosols is not nearly so well understood as the influence of greenhouse gases.

As Schwartz documents, the uncertainty in the climate influence of atmospheric aerosols limits any inference that can be drawn about future climate sensitivity — how much the temperature would rise due to a given increase in the atmospheric concentration of $CO_2$ alone — from the increase in global mean temperature already observed over the industrial period.


Stephen Schwartz

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"In order to appreciably reduce uncertainty in Earth's climate sensitivity the uncertainty in aerosol influences on climate must be reduced at least threefold," Schwartz concludes. He acknowledges that such a reduction in uncertainty presents an enormous challenge to the aerosol research community.

An editorial accompanying the paper credits Schwartz with presenting "a unique argument challenging the research community to reduce the uncertainty in aerosol forcing of climate change in order to reduce the uncertainty in climate sensitivity to an extent that would be more useful to decision makers." The editorial also suggests that, "Schwartz's calculations are not only of interest for the issue of climate change but may serve as a paradigm for environmental issues in general."

— Karen McNulty Walsh

*For more details, see http://www.ecd.bnl.gov/steve/Uncertainty Rqmts.pdf and http://www.ecd.bnl.gov/steve/schwartz.html#research.*